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PROCESS FOR CLEANING CARPETS

[Verfahren zum Reinigen von Teppichen]

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/1¹

Process for Cleaning Carpets

Carpeted floors are treated in a new process with an alkaline cleaning solution, which is prepared from a solid inorganic peroxide, an activator for this peroxide, a tenside, and if required other additives. The solution should act on the textile material for a few minutes, if required under a simultaneous mechanical treatment, and should then be removed to the greatest possible extent before the carpet dries. The new process causes a uniform cleaning of the entire surface, with which also stubborn stains can be completely removed.

/2

Description

The invention that will be described in the following concerns the cleaning of carpet and carpeted floors with the aid of aqueous liquors containing peroxide.

To clean carpets and fixed carpeted floors on location are used today, on the one hand, powdered products that are spread on the carpets and after a mechanical treatment are again vacuumed off and, on the other hand, aqueous cleaning liquors that are applied on the carpeted floors and are removed again

¹ Numbers in the margin indicate pagination in the foreign text.

from the carpets at least partially after a specific exposure time, if required while applying a mechanical treatment together with the dirt before the carpets are dry. In surface cleaning with aqueous liquors it is differentiated between the so-called shampooing processes in which at first a cleaning solution is sprayed on the carpets and is introduced into the carpet with the aid of brushes or similar mechanical processes before the cleaning solution or foam that has formed due to the mechanical treatment is again removed from the carpets by vacuuming, and the so-called liquid extraction process in which the cleaning agent solution is injected with a high pressure into the carpet and is immediately thereafter vacuumed off the carpet by means of the same device. If required, a rinsing step can also follow the treatment with the cleaning agent solution before the carpet dries. Both processes have been proven advantageous in the practice for flat soiled surfaces, but have failed for the most part on stained spots. It has therefore become necessary to treat individual spots before and after the cleaning treatment by means of the same spot cleaning process, while in dependence upon the quality of the spots such as tea and fruit juices have been proposed bleaching agents containing peroxide, but there is always the danger in this local application that the color of the textile material will be visibly damaged. It has already

been proposed to use aqueous solutions containing bleaching agents for cleaning flat carpeted surfaces (L. Carlhoff and H. Kruessmann in "German Dyer's Calendar," G. Dierkes Publisher, Frankfurt on the Main 1989, pages 215-224). It was shown, however, that for a sufficient removal of the spots must be used high concentrations of bleaching agents and long exposure times, which are connected in addition with a strong odor encumbrance when using peracetic acid, so that this method has not been successful in the practice. The proposal of DE 37 03 049 for accelerating the bleaching process with passable bleaching agent concentrations under the influence of microwaves can be applied only on portable textiles that can be treated in closed apparatuses. There is therefore the object of developing a process that makes it possible to clean rapidly and thoroughly even heavily stained carpeted floors with a small effort.

It was discovered that this object is attainable if a liquor with a specific composition is used for the cleaning.

The object of the invention is a process for cleaning carpets with the aid of aqueous solutions containing peroxide in which the textile is soaked with such a solution and if required is subjected to a mechanical treatment, this solution is then removed for the most part from the carpet, for example, by vacuuming, and the textile is dried, while the work is carried

out with an alkaline cleaning solution that is prepared from a solid inorganic peroxide, an activator for this peroxide, a tenside, and if required further additives. If it is practical, the textile can be treated in this process with water or a weakly acidic-acting aqueous solution after the exposure and if required after the cleaning solution, which is in turn vacuumed off if required, has been vacuumed off the textile before the textile is dried.

Aside from a good result in surface cleaning, the new process is characterized, above all, by an excellent cleaning power with respect to stains. Particularly noticeable is therein that not only the bleachable stains such as red wine, tea, coffee, or fruit juices are practically completely removed, but also stains containing pigments and oil such as shoe polish and motor oil can be removed with excellent results. Therefore, a single application of the cleaning solution is generally sufficient to remove all the existing stains from the carpeted floor. A pretreatment is normally not required. The process is suitable not only for carpeted floors of synthetic fibers such as, for example, polyamide, but also for sensitive textiles of natural fibers such as wool. There is practically never a color and fiber damage.

The fundamental steps of the process of the invention take place as follows:

Firstly, the cleaning solution is applied on the carpeted floor either over the entire surface or, however, locally if only the removal of individual stains is intended. The application takes place in a practical manner by spraying with the aid of suitable devices, but it is also possible to apply the same in another way, for example with the aid of a watering can or by dabbing the cleaning solution. The quantity of cleaning agent solution is selected like in the majority of the cleaning processes so that it is just sufficient for the complete wetting of all the textile fibers. The quantity of cleaning agent solution is therefore dependent upon the depth and weight of the textile material and upon the fineness of the pile; it can be determined without effort if necessary by means of pretests. In most carpeted floors are used about 0.3 to 3 liters of solution per m². As upper limit are considered about 200 percent by weight with reference to the textile weight. The cleaning solution can be applied cold, but for an acceleration of the cleaning procedure it is frequently practical to use a warm solution, preferably at a temperature of 70°C, in particular a temperature between 30 and 60°C.

After applying the cleaning agent solution can follow a mechanical treatment of the carpet, for example, with brushes with which the uniform distribution of the solution and the wetting of the fibers are improved and the dissolving of firmly adhering pigment stains can be facilitated. In the practice, the application of the solution and the mechanical treatment are frequently carried out with the same device, which aside from

/3

rotating brushes also has a tank for the dosing device.

After a specific exposure time, the liquid located on the carpet is removed again to as great an extent as possible from the carpet by vacuuming with the aid of suitable vacuuming devices. The collection of the liquid with the aid of liquid suction devices is the process used exclusively in commercial operations, but it does not exclude that in individual cases the liquid can be removed in another way, for example, by dabbing. The exposure time to the cleaning agent solution between the time of application and the time of removal can be very widely varied. In the presence of light stains it is possible to spray the cleaning solution in one work step and to immediately thereafter extract the same with the aid of so-called spray and extraction devices. The exposure time amounts therein only to fractions of seconds. With heavier stains, in particular

bleachable stains, it can be practical to extend the exposure time to several minutes and even up to one hour. It is advantageous therein to apply the cleaning agent solution by sections on the carpeted floor with the aid of a combined brushing device and to remove the same by suction after about 1 to 10 minutes.

After the removal of the cleaning agent solution, the carpet is dried. This can take place by means of the air itself, which can mean drying times of up to 2 days. However, it also possible to accelerate the drying by using air blowers or heat radiation.

In general, the residues that remain on the carpet due to the drying of the remaining cleaning solution do not have a disturbing effect. In individual cases, for example, with textiles that are highly sensitive to alkalis, it can be practical and advantageous to undertake one or more rinsing treatments before the final drying of the carpet. For the rinsing are used in the simplest case water or preferably a weakly acidic-acting aqueous solution, in particular a weakly acidic-acting buffer solution of citric acid or glycolic acid or sodium citrate citric acid buffer. The rinsing solution is adapted in quality and quantity so that the liquid that remains on the carpet after the rinsing treatment has a pH value close

to the neutral point, preferably between 5 and 7.5. Aside from the neutralization of the alkali, also the elimination of the excess bleaching agent can be particularly practical in the rinsing procedure of particularly sensitive dyes. The addition of suitable reduction agents, for example, ascorbic acid or pyruvic acid, or catalysts that degrade the peroxide, for example, the enzyme catalase, has shown here to be useful. If the rinsing solutions contain further active cleaning substances, for example tensides, then the rinsing can effect at the same time a further cleaning of the carpets. This is particularly advantageous when the bleaching solution has been applied only locally, but an entire surface cleaning is carried out with the rinsing solution. The application of the rinsing solution takes place practically after the cleaning solution has been extracted, but it is also possible to first dilute and neutralize the cleaning solution with the rinsing solution before the suctioning of the cleaning solution begins. In this case, a suction procedure follows the application of the rinsing solution or an equivalent measure takes place before the textile is dried. It is particularly advantageous if the rinsing step is carried out with the aid of the devices developed for the spray and extraction processes.

A characteristic feature of the invention is the composition of the cleaning solution or the type of its preparation. The cleaning solution is obtained by dissolving solid inorganic peroxide, the activator for this peroxide, and tenside, and if required further additives in water. The pH value of the ready-to-use solution should be preferably between 9 and 12, in particular between 9.5 and 11. It is adjusted accordingly by using alkali reacting components. Since the activators are acylation agents, salts of organic percarbonic acids are formed, which have an unexpectedly strong cleaning strength in this medium with respect to stains of all kinds even at low concentrations.

The used solid inorganic peroxides are compounds whose content of active oxygen (AO) in an aqueous acid solution can be tritiated with permanganate. Preferred are alkaline reacting peroxides, for example, perborate tetrahydrate, perborate monohydrate, and percarbonate, of which again perborate monohydrate is particularly preferred. Per 100 g of the finished cleaning solution are used of these peroxides generally 0.05 to 2 g, preferably 0.1 to 1 g, so that an active oxygen content of about 50 to 3000 ppm results in the solution.

The activators used according to the invention are compounds that are able to acylate hydrogen peroxide in the

alkaline aqueous solution. These activators have been developed in large numbers for the washing of textiles. They are in the majority of cases reactive amides or esters or anhydrides that are capable of transferring an acyl group to hydrogen peroxide. A list of these activators takes place, for example, in DE-A 38 32 589 on page 7. For the process of the invention are preferred N,N,N',N'-tetraacetyl ethylamine (TAED), 1,5-diacetyl-2,4-dioxohexahydro-1,3,5-triazine (DADHT) and pentaacetyl glucose (PAG), individually or in a mixture. The quantity of activator that is used for the preparation of the cleaning solution is selected in general in such a way that for the activation of 1 mol active oxygen are made available from the peroxide 0.02 to 1 mol, preferably 0.05 to 0.5 mol of reactive acyl groups of the activator. It amounts therefore generally to between 0.01 and 2 g, in particular 0.02 to 0.5 g per 100 g solution. As long as the activator together with the peroxide and if required the further additives of the cleaning solution are to be produced in solid form, it can be practical and advantageous to protect the activator from a premature reaction with the peroxide or other contents of the medium in a known manner by encapsulation or granulation, for example, according to DE 30 11 998.

The tensides used for the cleaning solution are non-ionic and preferably anionic tensides even though also in individual cases the use of other tenside types can be practical. The content of

/4

cleaning solution in the tensides amounts generally to between 0.005 and 0.5 g, preferably between 0.01 and 0.2 g per 100 g solution. The cleaning solution is very preferably predominantly or exclusively produced with these tensides, which together with the remaining components of the cleaning solution lead after drying to solid, brittle residues.

Suitable anionic tensides are in particular those of the sulfate or sulfonate type, but other types such as soaps, long-chain N-acyl sarcosinates, salts of fatty acid amides, or salts of ether carbonic acids such as those available from long-chain alkyl or alkyl phenyl polyglycol ethers and chloroacetic acid can be used. The anionic tensides are preferably used in the form of sodium salts.

Particularly suitable tensides of the sulfate type are the sulfuric acid monoesters of long-chain primary alcohols of natural and synthetic origin with 10 to 20 C atoms, that is, of fatty alcohols such as, for example, coconut fatty alcohols, tallow fatty alcohols, oleyl alcohol, or the C₁₀-C₂₀-oxoalcohols, and those of secondary alcohols with these chain lengths. Aside

from these are also taken into consideration sulfuric acid monoesters of aliphatic primary alcohols, secondary alcohols, or alkyl phenols ethoxylated with 1 to 6 mol ethylene oxide. Also suitable are sulfatized fatty acid alkanolamines and sulfatized fatty acid monoglycerides.

The tensides of the sulfonate type are above all sulfosuccinic acid monoesters and diesters with 6 to 22 C atoms in the alcohol parts, alkyl benzol sulfates with C₉-C₁₅-alkyl groups, and the esters of α -sulfofatty acids, for example, the α -sulfated methyl or ethyl esters of the hydrated coconut, palm kernel, or tallow fatty acids. Further useful tensides of the sulfonate type are alkanosulfonates that can be obtained from C₁₂-C₁₈-alkanes by sulfochlorination or sulfoxidation and additional hydrolysis or neutralization or by bisulfite addition on olefines, as well as olefin sulfonates that are mixtures of alkene and hydroxy alkanosulfonates as well as disulfonates as can be obtained, for example, from long-chain monoolefines with terminal or internal double bonds by sulfonation with gaseous sulfur trioxide and in addition the alkaline or acid hydrolysis of the sulfonation products.

Particularly preferably used are the fatty alcohol sulfates with 12 to 18 C-atoms in the alcohol part, the alkybenzol

sulfonate with 10 to 13 C-atoms in the alkyl chain, and mixtures of these tensides.

As non-ionic tensides are suitable in particular accumulation products of 1 to 30, preferably 3 to 15 mol ethylene oxide on 1 mol of a compound with 10 to 20 carbon atoms of the group of the alcohols, alkylene phenols, carbonic acids, and carbonic acid amides for the process of the invention. Particularly important are the accumulation products of ethylene oxide (EO) on long-chain primary and secondary alcohols such as, for example, fatty alcohols or oxalcohols as well as monoalkyl phenols or dialkyl phenols with 6 to 14 C-atoms in the alkyl groups. However, also other non-ionic tensides, for example, long-chain aminoxides and alkyl glycosides as well as mixed addition products of ethylene oxide and propylene oxide with long-chain alcohols can also be used. Particularly preferred non-ionic tensides are fatty alcohols or oxalcohols with 10 to 20 C-atoms, which are ethoxylated with 3 to 10 mol EO, and mixtures of differently strongly ethoxylated compounds of this type.

The cleaning solution can be used without further additives for the process of the invention. In many cases it can be practical to add to the cleaning solution other additives, which are usual in carpet cleaning agents. Particularly mentioned

should be sequestration agents, soil-repellent agents, inorganic salts, peroxide stabilizers, antistatically acting substances, and perfume. Also when selecting the additives, above all those that are obtained in greater quantities in cleaning agents, are preferred those that lead to solid residues on the carpet after drying, since these can also be vacuumed off later after drying.

The sequestration agents are soluble compounds, which are able to make the water hardness harmless. Examples of suitable sequestration agents that are preferred within the scope of the invention are sodium carbonate, pentasodium triphosphate, tetrasodium pyrophosphate, sodium silicate, trisodium citrate, and trisodium nitrolo triacetate. Their concentration in the cleaning solution is generally not over 2.5 g, preferably between 0.03 and 1.5 g per 100 g solution. The pure inorganic sequestration agents are generally used in a higher concentration than the organic ones. Also insoluble sequestration agents of the zeolite type, for example, zeolite NaA, can be useful. The additives that should prevent the staining of the carpeted floor are above all polymers that are soluble or dispersible in water, which do not lead after drying to films, but to brittle residues. Polyacrylates are preferably used. Their concentration in the cleaning solution is normally not over 0.5 percent by weight, preferably between 0.001 and

0.15 percent by weight. The addition of peroxide stabilizers serves to prevent the degradation of the peroxide in the cleaning agent solution before and during the application. It is as a rule a heavy metal sequestering agent, above all aminopolycarbonic acids and polyphosphonic acids or their salts, for example, ethylene diamine tetraacetic acid and hydroxy ethane diphosphonic acid. The content of these sequestering agents in the cleaning agent solution is usually not over 0.1 percent by weight, preferably between 0.005 and 0.05 percent by weight. As active ingredients that should effect a specific antistatic reinforcement of the carpeted floor are usually utilized quaternary ammonium compounds, which form on the textile material. Also inorganic salts can have an antistatic effect on the carpeted floors. The total content of additives in the cleaning agent solution amounts, calculated without sequestering agents, in general to no more than 1 percent by weight, preferably between 0.01 and 0.5 percent by weight.

The production of the cleaning solution is possible without problem by means of a separate dissolving of the individual active ingredients and additives in water. The reaction between peroxide and peroxide activator runs relatively rapidly with most activators also at ambient temperature, so that in most cases after about 2 to 10 minutes the solution is ready for use.

/5

At higher temperatures, the reaction runs correspondingly more rapidly. Since the percarbonic acid that forms in the cleaning agent solution gradually degrades, it is practical to prepare the cleaning solution anew before use. It has been shown to be advantageous at the same time that all the active ingredients and additives can be formulated so that together they form a solid product that contains all the components in the desired quantity ratios, so that for producing the cleaning solution it is only necessary to dissolve a corresponding quantity of this ready-to-use agent in water. Of course there is also the possibility of using basic solutions of individual components or component mixtures to produce the cleaning solution.

The new cleaning process has its special advantages in the cleaning of carpeted floors on location, since fixedly laid carpeted floors do not have access to the known cleaning processes for portable textiles. The same advantages are offered by the process of the invention to other textiles that cannot be accessible without problem with a conventional washing process such as wall coverings and upholstery. However, it is naturally also possible to apply the process on portable textiles, because it offers also advantages with respect to the

very complicated washing processes for such textiles due to its easy execution.

EXAMPLES

Example 1

The production of the cleaning agent solution of the invention takes place by dissolving in water the already premixed solid agents (1a-1d) that contain all the components.

	Example No.			
	1a	1b	1c	1d
Sodium dodecyl benzol sulfonate	5	3.5	-	-
Oxoalcohol C _{14/15} + EO (Dobanol® 45-7)	2	1	3	5
Na ₂ CO ₃	35	25	27	25
Sodium silicate (3.0:1)	8	7	-	-
Zeolite NaA	10	-	-	-
Copolymerizate of acrylic acid and maleic acid (Sokalan® CP5)	2	1.5	-	-
Hydroxy ethane diphosphonic acid	-	0.7	-	-
Alcalase® 2T	-	0.7	-	-
Na ₂ SO ₄	4	9.6	-	10
Water	7	3	-	-
Na-perborate monohydrate (15.3% AO)	20	-	60	-
Na-perborate (14.1% AO)	-	40	-	40
Tetraacetyl ethylene diamine (granulate, 94%)	7	8	10	20
pH value of a 1% solution	10.6	10.8	10.5	10.8

The products of Examples 1a and 1b were produced by mixing a spray dried tower powder with Na-perborate monohydrate or Na-perborate and TAED granulate as well as also enzyme. The products of Examples 1c and 1d were produced by spraying the molten Dobanol on the inorganic salts and then admixing the perborate monohydrate or percarbonate and TAED.

The cleaning effect of the new process was investigated in the practice on the differently strongly stained carpeted floors:

Example 2

A loosely laid mixed fiber carpeted floor with heavy stains of street dirt and massive oil spots was cleaned on one half with a commercially available carpet shampoo consisting of olefin sulfonate (2.3%), fatty alcohol sulfate (2.21%), non-film forming polyacrylate (8.7%) and water, and with a product according to the invention (No. 1a) [on the other half].

The commercially available carpet shampoo was diluted with cold tap water according to the manufacturer's instructions at a ratio of 1:6, was applied on the carpet by means of the dosing device of a single-disk machine, and brushed into the carpet with this machine. It was rinsed with clear water in addition with a spray and extraction process and then vacuumed. The shampooing, rinsing, and vacuuming took place always by steps so that the cleaned and still moist carpet would no longer be stepped on.

Results: The general staining with street dirt was no longer visible after drying. The oil spots were still present for the most part.

The product 1a of the invention was dissolved in warm water at 62°C with a concentration of 0.5% within approx. 5 minutes (pH = 10.5) and applied evenly over the entire surface of the carpet with the aid of a watering can. The applied quantity amounted on average 600 ml/m². After approx. 2 minutes exposure time,

/6

it was further processed with the single-disk machine and then rinsed with water by means of the spray and extraction device (approx. 1 l/m²) and vacuumed.

Results: The general staining and all the spots were removed. The carpet was again in perfect condition. The same good results were achieved in similarly soiled carpets with the product 1b.

Example 3

A new loosely laid Berber carpet with white base color and multicolor pattern was soiled with wine spots, which no process or product had been able to remove thus far.

The product 1a of the invention dissolved in warm water at 52°C with a concentration of 2% within approx. 5 minutes and applied in a quantity of about 50 ml/dm² on the spots with the aid of a watering can.

After an exposure time of 15 minutes, it was rinsed with water by means of the spray and extraction device and then vacuumed.

Results: The red wine spots were completely removed. No coloration changes were detected. The same result was achieved in another case of red wine spots with a product according to Example 1b.

Example 4

A fully synthetic almost white velour carpeted floor glued over the entire surface was soiled with red wine. No product or process had been able thus far to remove these spots.

The product 1a of the invention was dissolved in water at 38°C in a concentration of 1.5% within approx. 5 minutes and a quantity of on average 800 ml/m² was applied over the entire surface with the aid of a watering can. After approx. 30 minutes exposure time it was vacuumed with the aid of a spray and extraction device.

Results: The red wine spots were removed without leaving any residue.

Example 5

A bright beige-colored fully synthetic carpeted floor glued over the entire surface was soiled with colored pencils, ink,

coffee, oil, and other substances not directly identified. The carpet was also overall darkened.

The product 1c of the invention was dissolved in water at 51°C in a concentration of 1.5% within approx. 5 minutes (pH = 10.5) and a quantity of 30 ml/dm² was applied on the spots. After an exposure time of approx. 5 minutes the stains were worked over with a spray and extraction device. A neutral aqueous solution containing non-ionic tensides was sprayed on and the carpeted floor was vacuumed.

Results: All the spots were removed without leaving any residue. The carpet became brighter over its entire surface.

Example 6

A bright beige-colored fully synthetic velour carpeted floor glued over the entire surface was soiled with beverage stains (coffee, tea, juice, cola), shoe polish, and other substances not directly identified. The carpet was also overall darkened and so-called paths had formed.

The product 1a of the invention was dissolved in water at 52°C in a concentration of 1.5% within approx. 5 minutes. In addition, it was applied by means of a dosing device of a single-disk machine on the carpeted floor in a quantity of on average 1.5 l/m² and worked over with this machine. After another 15 minutes exposure time, it was set to a pH value of 4

and a buffer solution consisting of 20 percent by weight trisodium citrate and 8.6 percent by weight citric acid in water diluted at a ratio of 1:10 in cold tap water was applied with the aid of a spray and extraction device and again vacuumed. The vacuumed wastewater had a pH value of 5.9.

Results: The carpeted floor was clean and free of spots.

Patent Claims

1. A process for cleaning carpeted floors with the aid of aqueous solutions containing peroxide in which the textile is soaked with this solution and if required is subjected to a mechanical treatment, this solution is again removed for the most part from the textile, and the textile is dried, wherein the work is carried out with an alkaline cleaning solution, which was prepared from a solid inorganic peroxide, an activator for this peroxide, a tenside, and if required further additives.
2. The process of claim 1, wherein after the exposure and if required removal of the cleaning solution the textile is treated with water or a weakly acidic-acting aqueous solution, which is in turn suctioned before the textile is dried.
3. The process of claim 2, wherein the weakly acidic-acting aqueous solution contains buffering-acting substances.
4. The process of one of the claims 2 or 3, wherein the weakly

/7

acidic-acting aqueous solution contains a reducing substance or a peroxide-degrading catalyst.

5. The process of one of the claims 1 or 2, wherein to prepare the cleaning solution per 100 g of solution are used the following quantities of active ingredients:

0.05 to 2 g, preferably 0.1 to 1 g inorganic peroxide,

0.01 to 0.5 g, preferably 0.01 to 0.2 g tenside,

0 to 2.5 g, preferably 0.03 to 1.5 g sequestering agent, and

0 to 1 g, preferably 0.01 to 0.5 g other additives.

6. The process of claim 5, wherein the cleaning solution has a pH value between 9 and 12, preferably between 9.5 and 11.

7. The process of claim 5, wherein the inorganic peroxide is selected from the group of perborate tetrahydrate, perborate monohydrate, percarbonate, and their mixtures.

8. The process of claim 5, wherein the activator is selected from the group of tetraacetyl ethylene diamine, diacetyl dioxohexahydrotriazine, pentaacetyl glucose, and their mixtures.

9. The process of claim 5, wherein as additive is added a sequestering-acting compound from the group of sodium carbonate, pentasodium triphosphate, tetrasodium pyrophosphate, sodium silicate, trisodium citrate, trisodium nitrilo triacetate, and their mixtures.

10. The process of claim 5, wherein the cleaning solution is produced by dissolving a solid product that contains all the active ingredients in the desired quantity ratios.

/8

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